

WHAT IS CLAIMED IS:

1 1. Apparatus for incremental printing of an image; said  
2 apparatus comprising:  
3 means for addressing a region of the image at less  
4 than full (100%) coverage;  
5 means for adding further colorant quanta to selected  
6 pixels already receiving said colorant as part of the  
7 less-than-full coverage within the region;  
8 whereby, within the region, the amount of the colo-  
9 rant printed in some pixels is zero, in others is a first  
10 nonzero number of colorant quanta, and in still others is  
11 a second nonzero number of colorant quanta;  
12 *second?* wherein the *second* <sup>11</sup>first nonzero number is different from  
13 the *first* nonzero number; and  
14 means for printing the image including the region  
15 with the added further quanta.

1 2. The apparatus of claim 1, wherein the adding means  
2 further comprise:  
3 means for establishing a ratio of number of added-  
4 colorant pixels to total number of addressed pixels; and  
5 means for setting the ratio to a value below one-  
6 half.

*0.15 (line 10-16)*

1 3. The apparatus of claim 2, wherein:  
2 the setting means comprise means for setting the  
3 ratio to a value between 0.15 and 0.4 inclusive.

1 4. The apparatus of claim 3, wherein:

2 0 the setting means comprise means for accepting a hu-  
3 man operator manual selection to trade off banding robust-  
4 ness against granularity.

1 5. The apparatus of claim 4, wherein:

2 0 the accepting means comprise means for expressly pre-  
3 senting to the operator some indicia of the tradeoff.

1 6. The apparatus of claim 5, wherein the indicating means  
2 0 comprise a human-readable scale that indicates:

3  
4 increasing banding robustness in one direc-  
5 tion, and

6  
7 decreasing granularity in an opposite  
8 direction

9  
10 or equivalent.

00642417-081900

1 7. A method for reducing band effects in incremental  
2 printing of an image; said method comprising the steps of:  
3 printing a region of the image at less than full  
4 (100%) coverage; and

5 in order to compensate for colorant-placement error,  
6 adding further colorant quanta to selected pixels already  
7 receiving colorant as part of the less-than-full coverage  
8 within the region;

9 whereby, within the region, the amount of colorant  
10 printed in some pixels is zero, in others is a first  
11 nonzero number of colorant quanta, and in still others is  
12 a second nonzero number of colorant quanta;

13 wherein the second nonzero number is different from  
14 the first nonzero number.

1 8. The method of claim 7, wherein:

2 said full coverage is approximately one colorant  
3 quantum per printer pixel, on-average.

1 9. The method of claim 8, wherein: *Fig 2a.*

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter approximately equal to  
4 the length of a diagonal across a single printer pixel.

1 10. The method of claim 7, wherein: *cl 2, l 52-63*

2 said full coverage is approximately one-half colorant  
3 quantum per printer pixel, on-average.

1 11. The method of claim 10, wherein:

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter substantially equal to  
4 twice the height or twice the width of a single printer  
5 pixel.

1 12. The method of claim 7, wherein:

2 said full coverage is between one-half and one col-  
3 orant quanta per printer pixel, on-average. ?

1 13. The method of claim 12, wherein:

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter between one-half and one  
4 times the height or between one-half and one times the  
5 width of a single printer pixel. 7

1 14. The method of claim 7, further comprising the steps  
2 of:

3 in another region of the image, printing an area fill  
4 at less than double (200%) coverage; and ✓

5 within said other region, adding further colorant to  
6 selected pixels already receiving colorant as part of the  
7 area fill.

1 15. The method of claim 14, wherein:

2 said double coverage is approximately two colorant  
3 quanta per printer pixel, on-average.

006130" 47424960

1 16. The method of claim 15, wherein:

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter approximately equal to  
4 the length of a diagonal across a single printer pixel.

1 17. The method of claim 14, wherein:

2 said double coverage is approximately one colorant  
3 quanta per printer pixel, on-average.

1 18. The method of claim 17, wherein:

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter substantially equal to  
4 twice the height or twice the width of a single printer  
5 pixel.

1 19. The method of claim 14, wherein:

2 said double coverage is between one and two colorant  
3 quanta per printer pixel, on-average.

1 20. The method of claim 19, wherein:

2 each colorant quantum forms in the printed image a  
3 roughly circular dot of diameter between one and two times  
4 the height or between one and two times the width of a  
5 single printer pixel.

1 21. The method of claim 7, further comprising the step  
2 of:

3 at least approximately maintaining a particular ratio  
4 between said still other pixels and said pixels receiving  
5 colorant as part of the less-than-full coverage within the  
6 region.

1 22. A method of adding colorant in a region to which col-  
2 orant is already addressed, in incremental printing of an  
3 image; said method comprising the steps of:

4 automatically establishing a ratio of number of ad-  
5 ded-colorant pixels to total number of addressed pixels;  
6 setting the ratio to a value below one-half; and  
7 automatically printing a region of the image with  
8 said added-colorant pixels included at said ratio.

1 23. The method of claim 10, wherein:

2 the setting step comprises setting the ratio to a  
3 value between 0.15 and 0.4 inclusive.

1 24. The method of claim 11, wherein:

2 the setting step comprises a human operator selection  
3 to trade off banding robustness against granularity.

09642417-081900

0

1 25. The method of claim 12, wherein:  
2 the setting step comprises a human operator selection  
3 on a scale that expressly indicates:  
4  
5 increasing banding robustness in one direc-  
6 tion, and  
7  
8 decreasing granularity in an opposite  
9 direction,  
10  
11 or equivalent.

0

1 26. The method of claim 10, wherein:  
2 the setting step comprises a human operator selection  
3 on a scale that expressly indicates:  
4  
5 increasing banding robustness in one direc-  
6 tion, and  
7  
8 decreasing granularity in an opposite  
9 direction  
10  
11 or equivalent.

1 27. A method of adding colorant in a region to which col-  
2 orant is already addressed, in incremental printing of an  
3 image; said method comprising the steps of:

4 automatically adding colorant by employing a super-  
5 pixel that is very insensitive to characteristics of dot  
6 placement error; and

7 automatically printing a region of the image with  
8 said added colorant.

1 28. The method of claim 27, wherein:

2 the superpixel is intermediate in characteristics  
3 between:

4  $[1 \ 0; \ 0 \ 1],$

5  
6  $[2 \ 0; \ 0 \ 0].$

1 29. The method of claim 27, wherein the superpixel is  
2 selected from the group consisting of:

3  
4  $[2 \ 0; \ 0 \ 2],$

5  
6  $[1 \ 0; \ 1 \ 0],$

7  
8  $[1 \ 1; \ 0 \ 0],$

9  
10  $[0 \ 0; \ 1 \ 1],$

11  
12  $[0 \ 1; \ 0 \ 1].$



00642417.081900

1 30. A method of incremental printing of an image by con-  
2 struction from individual colorant quanta addressed to  
3 pixels of a printing grid; said method comprising the  
4 steps of:

5 for substantially all tonal levels in a range extend-  
6 ing at least from highlight regions to midtones:

7  
8 automatically addressing a first number of col-  
9 orant quanta to some pixels; and

10  
11 automatically addressing a second number of  
12 colorant quanta to other pixels, said sec-  
13 ond number being larger than said first  
14 number; and

15  
16 automatically printing a region of the image with  
17 said added colorant.

1 31. The method of claim 30, wherein:  
2 said range extends at least from ten percent area  
3 fill through forty percent area fill.

1 32. The method of claim 30, wherein:  
2 said other pixels are selected substantially at  
3 random from among said some pixels.